

# THE ECHINODERMS

OF THE

## WESTERN AUSTRALIAN MUSEUM.

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The authorities of the Western Australian Museum at Perth, having entrusted to me their collection of echinoderms for identification and study, I beg to offer here my sincere thanks for the honor they have thus done me. My obligation to Mr. Bernard H. Woodward, the director of the Museum, is particularly heavy, for his uniform courtesy and for the many favours he has shown me.

The collection itself is not a large one but it is of extraordinary interest, not only for some of the hitherto undescribed species it contains, but also for the light it throws on the range of many East Indian and Australian echinoderms. The number of specimens sent me is only 99, but the number of species is more than half that, no less than 58 being represented. The collection is thus a selected one, usually only one or two specimens representing each form. There is thus no opportunity for me to comment on the variability of these West Australian species.

The collection is notable for the large number of new and remarkable species it contains. There are no new crinoids, but five starfishes are undescribed, and one of these represents a new and remarkable genus, while three others are notably distinct forms. Of the ophiurans, four are new, one representing a new genus and the other three being very different from any near allies.

Of the echini, four, and probably five, are undescribed, and it is interesting to note that one of these is a cidarid, and another a centrechinid, the two oldest groups of Recent echini, while the other two are clypeastroids, a group particularly abundant and widespread in Tertiary times. Of the holothurians, certainly two, and

probably three, represent new forms, one of which may ultimately require a new generic name to emphasise its peculiarities. There are thus not less than 15 new species in this small collection, or more than a fourth of the total number. Of the others, at least 22 are not known from outside the Australian region. As 5 are not certainly identified, it follows that of 53 species, 37 or 70 % are characteristic of Australia, certainly a very notable fact. Of course, further knowledge of both the Australian and East Indian faunæ, will alter these figures, perhaps materially, but they are at least suggestive of the remarkable echinoderm fauna which awaits further study on the western coast of Australia.

Finally, the collection at hand is notable for the presence of many species whose occurrence on the western side of Australia was not previously known, and in some cases at least was hardly to be expected. Among the starfishes, the most notable case is that of *Anseropoda rosacea*, previously known from Japan and the Bay of Bengal. Among ophiurans, there are two species, *Pectinura dyscrita* and *Ophiothrix spongicola*, previously known only from New South Wales. Among echini, the occurrence of a *Temnopleurus* is particularly remarkable, while the presence of *Tretocidaris bracteata*, previously known only from the East Indies and Japan, is most interesting.

Holotypes of the new species described in this paper are in the Western Australian Museum at Perth, but cotypes of ten of them (wherever the holotype was not the only specimen) are now in the Museum of Comparative Zoölogy.

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## CRINOIDEA.

There are only five crinoids in the collection. One of these (No. 4922) is a damaged calyx with only the basal part of the arms, and hence is not identified, but it is certainly not one of the Comasteridae. The other four represent four different species, but all belong to the single family Comasteridae. The chief interest of these crinoids lies in the fact that one of the species is new to the fauna of Australia, not being included in the list of "Recent Crinoids of Australia" published in 1911 by Mr. Austin Hobart Clark.<sup>1</sup>

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<sup>1</sup> Clark, A. H., 1911. "The Recent Crinoids of Australia," Mem. Austr. Mus., IV, pt. 15.

## COMATULA SOLARIS.

Lamarck, 1816. Hist. Nat. Anim. s. Vert., vol. 2, p. 533.

This species is well-known from Queensland and Torres Strait, and has been recorded from as far west as Holothuria Bank. Its occurrence on the western coast of Australia is therefore not remarkable. The specimen in the present collection is in what Mr. Clark (l.c.) calls the "broad-armed and generally robust phase" and is unicolor—almost black.

Coast of West Australia. One specimen. No. 260.

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## COMANTHUS ALTERNANS.

*Actinometra alternans*, P. H. Carpenter, 1881. Notes from Leyden Mus., vol. 3, p. 208.

This species has been recorded from the Philippines and from Port Molle, Queensland. Its occurrence, therefore, at the Abrolhos Islands, North-western Australia, is of no little interest. The specimen before me is small, having only 34 arms, each about 60 mm. long, which is an inaccurate way of saying that the tip of each ray is a little more than 60 mm. from the centre of the disk. There are two cirri, attached to the margin of a flat centre-dorsal less than 3 mm. in diameter; the larger cirrus is broken; the smaller has 15 very short, slightly swollen joints. In three of the rays the II Br series is 4 (3+4), the III Br is 2, and the IV Br is 4 (3+4) again; in a fourth ray, on one side, III Br is 4 (3+4) and IV Br is 2; in the fifth ray, on both sides II Br is 2; and III Br is 2 also. The colour of this specimen is light wood-brown. On account of its small size and the fact that the two arms fail to show the regular alternation of the division series, I have hesitated in calling this specimen *alternans*, but I think there is really little doubt that it is a young example of that species.

Abrolhos Islands, Western Australia. One specimen, No. 125.

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## COMANTHUS PARVICIRRA.

*Alecto parvicirra*, J. Müller, 1841, Arch. f. Naturg., Jhrg. 7, vol. 1, p. 145.

*Comanthus parvicirra*, A. H. Clark, 1911. Mem. Aust. Mus., IV, pt. 15, p. 758.

The occurrence of this species in the collection is quite to be expected since it has been previously recorded from Fremantle.

Coast of West Australia. One specimen, without number.

## COMANTHUS POLYCNEMIS.

A. H. Clark, 1910. Proc. U.S. Nat. Mus., vol. 36, p. 396.

The specimen which I refer to this species is a small one, scarcely 120 mm. across, with 57 arms. The colour is a very deep olive-green, but the young arms and the cirri are pale brown or a dirty cream colour. There are 15 cirri, each with 15 joints, but they have the appearance of being fugaceous and the small thin centrodorsal adds weight to such an impression. Unfortunately, Mr. Clark's description is rather unsatisfactory, no statement as to size, colour, or number of arms being made. There is a vague reference "to my previous list," but I have not succeeded in finding the list to which he refers. It is possible, therefore, that I am wrong in referring this specimen to *polycnemis* (especially in view of the presence of numerous cirri) but the arrangement of the division series is a very noticeable character.

Abrolhos Islands, Western Australia. One specimen, No. 124.

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ASTEROIDEA.

The starfishes are a most interesting section of this collection, since five of the sixteen appear to be undescribed, and one of these represents a new and interesting genus. Of the sixteen species, only three are certainly known from outside of the Australasian region.

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LINDIA MACULATA.

Müller and Troschel, 1842. Sys. Ast. p. 77.

A small specimen, with four of the seven arms broken, proves this widespread species to be a native of the West Australian coast. The colour in life is recorded as "buff with dark bands." R.= 80 mm.

Between Fremantle and Geraldton, W.A., 80-120 fms., No. 4919.

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TOSIA AUSTRALIS.

Gray, 1840. Ann. Mag. Nat. Hist., vol. 6, p. 281.

Since the type of this species was from Swan River, Western Australia, it is not strange that it should be represented in the present lot.

From piles of an old jetty, Fremantle, W.A. Two specimens, No. 6045.



PENTAGONASTER STIBARUS,<sup>1</sup> sp. nov.

## PLATE XVII.

Rays 5.  $R=52$  mm.,  $r=28$  mm.  $R$  2r. Interbrachial arcs well rounded. Rays broad and flat. Breadth at base, 29 mm. Disc large, very little arched; vertical diameter only about 13 mm. Superomarginal plates, 40, that is, eight on each side or four on each margin of each arm; the terminal pair the largest and much swollen; the others are subequal and little swollen. Each plate is surrounded by a single, double or even triple series of minute, crowded, flat-topped granules, but the surface of each plate is perfectly smooth. Inferomarginals 60, that is, twelve on each side or six on each margin of each arm; on each side of the starfish, the six median inferomarginals correspond exactly in position with the superomarginals above them, but the swollen terminal superomarginal overlies three inferomarginals, of which the antepenultimate (and not the penultimate nor the last) is the largest and is slightly swollen. The penultimate is distinctly smaller but is equally swollen, while the last is quite small and is almost or quite flat. The inferomarginals are smooth and surrounded by granules exactly as are the superomarginals.

The plates covering the abactinal surface are smooth, polygonal or rounded and surrounded, like the marginals, by a series of flat-topped granules. The largest are in the interradial areas and are four or five millimetres across; the smallest are near the tips of the rays. Distally, the median radial series are slightly swollen, while proximally, in the type (the larger specimen), each plate bears a blunt low spine, or high tubercle. Two or three plates not in the median radial series, but near the centre of the disk, bear similar but small tubercles. In the smaller specimen ( $R=41$  mm.) such a tubercle is indicated on only one plate, the dorso-central, while the five primary interradial plates are much larger and more conspicuous than in the type. In both specimens, the rounded triangular madreporic plate lies just distal to one of the primary interradials; in the type, it is much swollen.

The actinal surface is covered by polygonal plates similar to those of the abactinal side and like them surrounded by series of granules. Adjoining each mouth angle is a single plate, distal to

<sup>1</sup> GR. *stibarus*—compact, sturdy.

which are a pair of plates of about equal size. Distal to them is a series of three or four plates. Theoretically this series is succeeded by one of six and that by one of eight plates, the median four of which abut on the inferomarginals. Actually, however, these last two series are irregular in number, form, size and position of the plates. In any case, however, the plates which abut on the inferomarginals are the smallest and those next the mouth plates are the largest of the actinal intermediate plates.

The adambulacral plates are about twice as wide as long. Their armature consists of a series of three stout, blunt, somewhat prismatic, furrow-spines, of which the middle one is either the largest or the smallest. This series is parallel to the furrow, and directly back of it, on the surface of the plate, is a second series of similar, but shorter and stouter spines. There may be either two or three spines in this series but three seems to be the typical number and when there are only two they are exceptionally stout. The remaining surface of each plate is covered by six to ten small, low, truncate, prismatic spines, arranged in series of three (rarely two or four) parallel to the furrow; the outermost are very similar to the granules surrounding the actinal plates. The armature of the oral plates consists of six large marginal spines on each side of the "jaw," the two at the apex being the largest. On the surface of each jaw there are six to ten similar but smaller spines (three to five on each side) while the low keel of the jaw is concealed by about eight thick prismatic spinules arranged in a double series.

Excavate pedicellariae, similar to those of *P. pulchellus* and *P. dübeni*, but smaller than those of the former and larger than those of the latter, occur on many of the abactinal plates. None were found on the actinal surface of either specimen. They occur irregularly scattered and may be present on any plate, but no plate carries more than one. They may have either two or three valves; in the smaller specimen they are mostly two-valved, but in the type, the three-valved form predominates.

Colour of type, very pale fawn; the smaller specimen is brown-yellow. In life, the colour of both was "bright orange."

Between Fremantle and Geraldton, W.A. 40-100 fms. Two specimens, No. 4916. The larger specimen is the Type.

This species is obviously related to *P. dübeni*, Gray, but is at once distinguished by its much broader rays, covered by nearly

circular plates, in three-five longitudinal series, and the much larger terminal superomarginal plates. In *dübeni* when  $R=41$ ,  $r$ =only 17; the arm is 20 mm. broad at base and only 11 mm. at a point halfway between tip and centre of disk; there are 50-60 superomarginals. In *stibarus* with  $R=41$  mm.,  $r=23$ ,  $br=26$  and  $br$  at the middle of arm=20 mm. there are only 40 superomarginals. In *dübeni*, the abactinal plates on the rays are in only 1-3 series, swollen and much elongated parallel to the axis of the ray, but in *stibarus*, they are nearly or quite flat and more or less circular. From *pulchellus*, the type of the genus, *stibarus* differs greatly in the much closer plating of both surfaces, with smaller granules between the plates, and in the pedicellariae being abactinal instead of actinal. If the abactinal tubercles are a constant feature of adult *stibarus*, they will serve as an additional specific character.

Fisher<sup>1</sup> has stated as a character of *Pentagonaster* that it is the last plate of each marginal series which is largest and not the penultimate or antepenultimate. Examination of four specimens of *pulchellus* and three of *dübeni* shows that while it is the last of the superomarginals which is largest, of the inferomarginals, the last is smallest and the penultimate is largest, though sometimes approximately equalled by the antepenultimate. In the type of *stibarus* as already stated, the antepenultimate superomarginal is largest, but in the smaller specimen in only two of the ten possible cases is the antepenultimate largest, in the other eight it is the penultimate which exceeds. This difference, however, is more important on paper than in reality for in every series in the two specimens it is the fourth plate from the median interradian line which is enlarged and the apparent difference is due to whether one or two small plates are developed distal to it. The characteristic arrangement of the marginals in *Pentagonaster* may then be stated thus: The last superomarginal plate is enlarged and swollen and overlies the last two or three inferomarginals; of these the penultimate, or sometimes the antepenultimate, is largest.

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<sup>1</sup> 1911. Bull. U.S. Nat. Mus., No. 76, pp. 166 and 171.

## NECTRIA OCELLIFERA.

*Asterias ocellifera*, Lamarck, 1915. Anim. s. Vert. vol. 2 p. 553.

*Nectria ocellifera*, Gray, 1840. Ann. Mag. Nat. Hist. vol. 6, p. 287. (*oculifera* lap. cal.)

The number of species in the genus *Nectria* has for many years been a matter of dispute. Perrier first called attention to the differences between the original specimens at Paris and the specimens in the British Museum. He <sup>1</sup> was sure they represented two different species and suspected that there was possible a third in the Paris Museum. Sladen, <sup>2</sup> however, on the basis of the *Challenger* material was inclined to think that there was only a single species, the differences to which Perrier called attention not being of specific value. Fisher, in a recent discussion of the genus, points out that the material in the M.C.Z. collection indicates the existence of two species. Very recently the M.C.Z. has received from Mr. Joseph Gabriel some well preserved specimens of *Nectria* from Victoria, and these, on comparison with two specimens from West Australia in the present collection, enable me to throw some light on the question.

The West Australian specimens are essentially alike except that one has six rays, and is somewhat smaller than the other. These specimens agree well with Perrier's description of *ocellifera* and I feel little hesitation in referring them to that species. The specimens from Victoria, on the other hand are obviously different and seem to agree very well with Ferrier's description of his species *ocellata* which was based on Gray's specimen in the British Museum. As all my specimens are well-grown and of approximately the same size, it is clear that the differences are not in any way to be correlated with age, and I believe both species are fully entitled to recognition. The most striking difference between them is in the appearance of the dorsal paxilliform ossicles; in *ocellifera* the top of each ossicle is covered by a group of 10-30 flat, irregularly polygonal, well-spaced granules, surrounded by a marginal crown of 10-25 large spaced, flaring flattened scale-like projections; in *ocellata* the top of each ossicle is much smaller and bears 10-30 rounded, well-spaced hemispherical grains, surrounded by a crowded series of

<sup>1</sup> C. Perrier, 1876. Arch. Zool. Exp. vol. 5, pp. 1-6.

<sup>2</sup> W. P. Sladen, 1889. *Challenger* Asteroids, pp. 318-321.

<sup>3</sup> W. K. Fisher, 1911. Bull. U.S. Nat. Mus., No. 76, pp. 163, 164.

15-30 grains, a little higher than, but not essentially different from, those on the top. As a result of this difference in the ossicles the madreporic plate in *ocellata* is plainly visible and the papulae seem larger and more conspicuous than in *ocellifera* where also the madreporic plate is more or less concealed. The marginal plates are more numerous in *ocellata* than in *ocellifera*; in a specimen of the former having  $R=70$  there are 23 superomarginals on one side of a ray, while in an *ocellifera* with  $R=83$ , there are only 18. The actual intermediate areas are much more closely granulated in *ocellata* than in *ocellifera*, in the latter the separate plates are quite distinctly indicated by the groups of granules which they bear. The figures given by Sladen in the *Challenger* Report are all illustrations of *ocellata* and it seems to me probable that he had not seen *ocellifera*.

Whether the large specimen in the M.C.Z. collection (No. 1932) upon which Fisher made his anatomical investigations is *ocellata* or represents a new species, I am unable to decide. It is much larger than any *ocellata* I have seen, and its peculiarities may be a matter of age, but I confess that I think it likely it represents a third species. The dorsal paxilliform ossicles are close fitting polygons unlike any that I have seen in other Nectrias. On the other hand, the larger specimen of *ocellata* have pedicellariae and occasionally show inter-marginal papulae in the interbrachial arc (though, it must be added, very rarely), while both of these features, particularly emphasised by Fisher, seem to be wanting in the specimens of *ocellifera*. It seems to me that neither is a constant generic character.

Whether *ocellata* and *ocellifera* have distinct geographical ranges remains to be determined. The exact locality whence Lamarck's type came from is not known. The British Museum specimens described by Gray and by Perrier, the *Challenger* material and all of the specimens in the M.C.Z. are from south-eastern Australia or Tasmania, and these are all *ocellata*. The two specimens before me from West Australia are *ocellifera*. So far as the evidence goes, then, the areas occupied by the two species do not overlap.

The West Australian specimens have the following data: Between Fremantle and Geraldton, W.A., 60-100 fms. Colour orange. No. 4914. Two specimens.

STELLASTER MEGALOPREPES,<sup>1</sup> sp. nov.

## PLATE XVIII.

Rays 5.  $R=120$  mm.  $r.=45$  m.  $R.=2\frac{2}{3}r$ . Br at base= $40$  mm.; at half-way point,  $24$  mm. Interbranchial arcs well rounded. Disk large, not highly arched, yet distinctly convex; vertical diameter about  $20$  mm. Entire abactinal surface covered by a closely granulated membrane, obscuring but not actually concealing the outlines of the underlying plates. Superomarginals,  $22$  on each side of ray; median interradiial pair about  $12$  mm. high by  $4$  mm. wide, but distally the height decreases with little change in width, the fifteenth plate from the interradius being about  $6$  mm. high by  $3.5$  mm. wide (or long). At the tip of the ray the  $19-21$  superomarginals of the two sides are in contact abactinally but the twenty-second pair are so small, they are completely separated from each other by the twenty-first pair being in close contact with the rather large terminal plate. Abactinal ends of superomarginals (except distalmost) rounded wedge-shape, with a group of papulae on either side. No spines, tubercles or pedicellariae on any superomarginals. Abactinal skeletal plates small, largest in interradiial areas, where they may measure nearly five millimetres across. Median radial series consists of about forty plates and runs to a point about nine or ten millimetres proximal to tip of ray, where meeting of superomarginals of opposite sides puts an end to abactinal plating. On each side of median radial series, at base of arm, are two parallel series of somewhat smaller plates; the one adjoining the median series runs about as far as the fifteenth superomarginal while the outer one ends at the eleventh or twelfth. Excepting thirty (more or fewer) distal, medial radial plates and about ten or a dozen distal plates in each of the two adjoining series, all abactinal plates carry sharp conical spines; the largest are situated one at the base of each ray on the first of the median radial plates; these five spines are about five millimetres high and two in diameter, at base; most of the spines are two millimetres high or less, but all if uninjured are very sharp. Papulae numerous but rather small, in groups of  $3-20$ , all over abactinal surface; largest groups between upper ends of superomarginal plates. Madreporic plate,  $7$  mm. long by  $6$  wide, rounded triangular, its proximal margin  $12$  mm. from centre of disk. Arms very distinct.

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<sup>1</sup> Gr. *megalo* *prepēs*—magnificent, splendid.



Actinal surface, covered, like abactinal, with a closely granulated membrane, but outlines of plates quite distinct in dried specimen. Inferomarginal plates, 22 on each side of a ray, corresponding exactly in position to superomarginals, and approximating them in size; the distal margin of each is greatly modified by the series of spines borne thereon. Beginning at tip of ray (to pass from simple to complex conditions), each inferomarginal plate carries at or below the middle of its distal margin a stout, flattened, bluntly pointed spine, rather longer than the plate and lying appressed to the surface of the ray and parallel with its long axis. On plates 4-8 a second similar but smaller spine is present, below (*i.e.* actinal to) the first; on plates 9-11, a third spine still smaller arises below the second; on plates 12-14 there is a fourth; on plates 15-18, a fifth; and on plates 19-22, a sixth. On plates 20-22 a second series of two or three spines appears, proximal to the first, at the base of the second and third spines of that series. With increase in number, there is a change of position and a marked increase in length of these marginal spines, so that on the median interradi al inferomarginals, each of which bears 8 or 9 spines, the original first spine is 7 or 9 mm. long, and is borne on the outer proximal corner of the plate.

Actinal intermediate plates rather few (25-30) aside from the actino-lateral series, which reaches scarcely to the middle of the ray; very rarely a small spine, similar to those on the inferomarginals may be seen on one of the distal intermediate plates. Adambulacral plates, about as long as wide; armature in two series, parallel to furrow; an inner series of 6 or 7 slender spines, median longest, adoral and aboral, shorter and subequal; and an outer of 2 (or rarely 3) very broad thin and flat, truncate spines, erect on surface of plate; these flat spines are 3-4 mm. long and 1-1.5 mm. wide. Oral plates with about 7 spines on each side, of which the innermost are longest and stoutest, and are distinctly prismatic; surface of each jaw with about 3 large, flat, thin spines similar to those in outer adambulacral series.

Pedicellariae abundant and of two kinds. Scattered irregularly over the abactinal surface are small *bivalved* pedicellariae (using Fisher's terminology), with jaws about half a millimetre long. Less common, and generally situated near a spine, are tall, 2-valved *spatulate* pedicellariae, with jaws nearly a millimetre high. Bi-



valved pedicellariae sometimes occur with three jaws and they often have the jaws as high as wide. It is easy to follow the transition from bivalved to spatulate pedicellariae, in this starfish. Both kinds of pedicellariae occur on the inferomarginal plates, but the bivalved are much the more common. Large spatulate pedicellariae occur on many adambulacral plates usually at the adoral end between the two series of spines. Groups of 8-20 large bivalved pedicellariae cover the surface of the actinolateral plates and give them a rough appearance; some of these pedicellariae have jaws more than a millimetre long.

The colour of this fine starfish in life is said to have been "buff above, purple star around mouth." The dry specimen is light reddish-buff above and reddish-white below; the oral plates and first four or five actinolaterals on each side of each ambulacral furrow are dull rose-red, but more or less of the centre of each actinolateral plate is whitish, the area increasing on the more distal plates; inferomarginal and adambulacral spines white.

Off Port Hedland, W.A. One specimen, No. 4030. Type.

This beautiful starfish is quite distinct from any other member of the genus, yet seems to be a true *Stellaster*. The inferomarginal spines and the numerous sharp conical spinules on the abactinal surface are characteristic, while the adambulacral armature and the coloration add important distinctive marks.

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## OREASTER GRACILIS.

Lütken, 1871. Vid. Med. f. 1871, p. 260.

This West Australian specimen equals in size that in the British Museum, described by Bell, for R. = 220 mm., but there are only 25 or 26 marginal plates as against 30 in that specimen. There are no data with the present specimen other than the general statement that it is from West Australia.

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## OREASTER NODULOSUS.

*Pentaceros nodulosus*, Perrier, 1876. Arch. Zool. Exp., vol. 5, p. 53.  
*Oreaster nodulosus*, Bell, 1884, Proc. Zool. Soc., London, p. 66.

Although this specimen is much larger than either of those mentioned by Bell, for R. = 120 mm. as against 70 in his larger specimen, there are only two more marginal plates, 19 instead of 17

on each side of a ray. This species is notable, judging from the present individual, for its smooth surface, the plates being flattened, the tubercles rounded and the granulation so even that at a little distance the specimen looks water-worn, an illusion which examination with a lens dispels. The papular areas are small but very sharply defined. There are 14 or 15 tubercles on each median radial ridge; the largest, which is about 13 mm. in diameter and 8 mm. high, is at the radial angle of the disk, the others being successively smaller distally. There are no data with the specimen, but it is from West Australia.

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### CULCITASTER,<sup>1</sup> gen. nov.

Form stellate, but rays short and disk disproportionately large. Marginal plates concealed, except on terminal third of ray. No large terminal marginals. Abactinal skeleton, coarsely reticulate with numerous large papular areas, regularly arranged in sixes or sevens around each plate. Entire animal covered by a closely granulated skin. No large spines or tubercles. Actinal intermediate areas very large covered with a flat pavement of polygonal plate, arranged in very regular series. Bivalved and spatulate pedicellariae present, at least actinally. Type species—*Culcitaster anamesus* sp. nov.

This remarkable genus is so perfectly intermediate between *Oreaster* and *Culcita*, when seen from above, one might find justification for putting the presentspecies in either of those genera. The actinal surface, however, is more distinctive and makes it desirable, if not positively necessary, to establish a new genus. One can easily imagine the rays of an *Oreaster gracilis* being shortened and the disk enlarged and puffed out until its appearance would be very much like that of *Culcitaster*, in its dorsal aspect, and if the process continued until the virtual disappearance of the ray, there would be difficulty in distinguishing such a specimen from *Culcita schmideliana*. But a glance at the actinal surface would be sufficient to distinguish *Culcitaster*, for no *Oreaster* or *Culcita*, now known, has any such regularly tessellated intermediate areas as characterise this new genus.

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<sup>1</sup> *Culcita*, a well-known genus of starfishes + *aster* a common termination for starfish genera.

CULCITASTER ANAMESUS,<sup>1</sup> sp. nov.

PLATE XIX.

Rays 5. R.= 185 mm. r = 110 mm. Br. at base=70 mm. Br. at 20mm. from tip of ray, 28 mm. Disk circular somewhat swollen, at least 200 mm. in diameter, and projecting beyond superomarginals in all interradian areas. Entire animal covered with a closely though rather coarsely granulated skin, which conceals many of the marginal plates but through which most of the abactinal plates are discernible. These plates seem to be rounded or stellate and are united with each other by narrow radiating plates, six or seven to each central plate. All the space between these radiating plates is occupied by papulae, so that the papular areas, each with dozens of papulae, are more or less triangular in shape and are arranged in groups of six or seven around each primary abactinal plate. On the rays, distal to the disk, one can distinguish at least three longitudinal series of plates and hence the papular areas have a linear arrangement. Six or eight superomarginal plates on each side of the tip of the ray are easily recognisable; the last four or five are high and narrow and at least on two arms, the two distalmost pairs meet abactinally in the median line. Terminal plates relatively very small. Tip of ray turned up so far that as in *Culcita*, the ambulacral grooves extend on to the abactinal surface.

Actinal surface flat, tessellated, covering-membrane not concealing the outlines of the plates. Distal to each mouth angle is a large rhomboidal plate about 18 mm. across; from its two distal sides extend the series of conspicuous actinolateral plates, at first nearly square but soon becoming evidently wider than long. Distal to the large rhomboidal plate is a similar but smaller plate, its two proximal sides in contact with the first actinolateral plates; from its two distal sides extend series of plates adjoining and parallel to the actinolaterals. Distal to the second rhomboidal plate is a similar but smaller plate from whose distal sides, series parallel to the actinolaterals again arise. Distal to the third rhomboidal plate is a pair of narrow plates lying side by side, from the distal ends of each of which a series of four or five similar plates extends to the margin of the area. Adjoining each of these series are parallel rows which

<sup>1</sup> Gr. *anamesos*—in the middle; in reference to its intermediate position.

extend from the actinolaterals (beginning with the third) to the margin. At the margin of each interrarial area, the regular serial arrangement of actinal plates is interrupted by the intercalation of small rounded or polygonal plates, some of which also crowd in between the lower ends of the inferomarginals.

Adambulacral plates short and not very wide ; there are about two to each actinolateral plate. Armature in a double series ; inner of 7-9 rather slender spines, parallel to furrow, median longest and adoral and aboral shortest and subequal ; outer of two or three very short blunt spines about 2 mm. long and 1-2 mm. thick, on actinal surface of plate, parallel to furrow, median (or adoral of two) longest and stoutest. Oral plates with about a dozen spines on each margin ; proximal very large, 7 or 8 mm. long, 3 or 4 mm. thick at tip ; distal spines smaller : distalmost grading into inner series of first adambulacral plate ; each oral plate bears on its surface 3 or 4 very stout, low spines, similar to those of the outer adambulacral series.

Pedicellariae abundant on actinal surface, but not observed in this specimen abactinally. On adambulacral plates are very heavy *spatulate* pedicellariae with two jaws ; these are at adoral end of plate and may be one, two or three in number ; if there are two or three, one is usually much the largest. Scattered all over the actinal interrarial areas, but most abundant on the radial ends of the actinolateral plates are *bivalved* pedicellariae with jaws a millimetre wide or less.

Colour above, light grey ; actinal surface more yellow-brown.

There are no data with this extraordinary starfish, but it is said to have been taken on the coast of West Australia. It is difficult to understand how so large and conspicuous a form should have so long been undescribed, but I can find nothing in the literature which would warrant the belief that specimens had ever been seen by European zoologists. The swollen circular disk beyond which project the short stumpy rays give the animal a very odd appearance, while the regular actinal plating covered with a closely granulated membrane is remarkably distinctive.

There can be little doubt that the genus is intermediate between *Oreaster* and *Culcita*.

LINCKIA TYLOPLAX,<sup>1</sup> sp. nov.

PLATE XX.

Rays 5, R. = 150 mm. r. 25 mm. R. = 6r. Br. at base = 27 mm. Br. at half-way point = 18 mm. Disk small, but much elevated vertical diametre about 20 mm. Rays tapering to a blunt point. Whole body surface covered by a granular membrane; granules largest near the centres of abactinal plates smallest on papular areas. Abactinal skeleton composed of 3-5 irregular series of rounded plates, with smaller plates scattered among them. Larger plates, nearly all swollen into rounded or flat-topped knobs, 2-5 mm. in diameter and about 2 mm. high. Between the plates are papular areas, 2-3 mm. across, with numerous small papulae. Madreporic body large, 7 mm. in diameter, about 15 mm. from centre of disk. Marginal plates fairly distinct, especially near tip of ray. Superomarginals about 43 on each side of a ray, the basal ones at least, knobbed. Inferomarginals of about the same number but less distinctly knobbed. Intramarginal papular areas well developed, nearly to tip of ray. Two series of actinal intermediate plates extend nearly or quite to tip of ray; actinolateral series adjoining adambulacral plates much larger than the second series, except near tip of arm. Papular areas present on actinal surface not only between inferomarginals and actinal intermediate plates but also between the two series of the latter, even on the actinal interradiar areas.

Adambulacral plates small; armature characteristically Linckian; each plate bears two short, thick, blunt spines on its furrow margin and a larger tubercle-like spine, 2 mm. long by 1 mm. thick, on its actinal surface. Armature of oral plates similar and equal to that of two adambulacrals. No pedicellariae.

Colour, light brown above, darkest on knobs; actinal surface nearly white.

Between Fremantle and Geraldton, W.A., 80-120 fms.

Two specimens. No. 4931. The larger specimen is the Type.

The presence of actinal papulae would almost warrant a new genus for this interesting starfish. Its abactinal aspect is much like some species of *Nardoa*, but the adambulacral armature precludes its inclusion in that genus. It does not seem to be very nearly related to any other previously known member of the family.

<sup>1</sup> GK. *tudos*—a knob; *plax*—a plate.

## ASTERINA GUNNII.

Gray, 1840. Ann. Mag. Nat. Hist., vol. 6, p. 289.

The occurrence of this species on the West Australian coast is quite to have been expected. All the specimens have six rays.

From piles of old jetty, Fremantle, W.A. Two specimens.

No. 6044. Without data, two specimens in poor condition.

Nos. 146 and 148.

## ANSEROPODA ROSACEA.

*Asterias rosaceus*, Lamarck, 1816, Anim. s. Vert. vol. 2, p. 558, par. 3.

*Anseropoda rosacea*, Fisher, 1906. Bull. U.S. Fish. Comm. for 1903, p. 1089.

This is one of the notable starfishes in the collection, for its occurrence off West Australia is very interesting, even if not surprising. The present specimen is 168 mm. across, and thus somewhat smaller than the specimen described by Müller and Troschel (1842) but larger than the one so finely figured by Koehler in his account (1910) of the shallow-water starfishes of the Indian Museum (Pl. XX). The individual from West Australia is, in its dry condition, dull, deep cream-colour with not very numerous, well scattered small spots of deep purple on the upper surface. It is remarkable for having 16 rays instead of the typical number, 15.

From Port Hedland, W.A. No. 4029.

ECHINASTER ARCYSTATUS,<sup>1</sup> sp. nov.

## PLATE XXI.

Rays 5. R.=130 mm. r.=20 mm. R.=6.5r. Br. at base =24 mm. Br. at half-way point=18 mm. Disk small; vertical diameter about 20 mm. Rays rounded, tapering to a rather blunt point. Abactinal skeleton and that of sides of rays forming a very distinct net-work with meshes 4-10 mm. in diameter, and occupied by 10-60 papulae. The skeletal ridges carry numerous, but well-spaced, bluntly pointed spinelets about a millimetre high. These

<sup>1</sup> GR. *arkustatos*—surrounded with nets, in allusion to the conspicuous reticulations of the abactinal skeleton. By an unusual typographical error in Hinds and Noble's Classic Greek Dictionary, 1901, p. 102, I was led to write the word *acrystata* in naming a brittle star in 1911, Bull. U.S. Nat. Mus. No. 75, p. 145. Under the circumstances, the name given is obviously a typographical error and the brittle-star should be known as *Amphiura arcystata*.

are most numerous and sharpest near tips of rays. \* Madreporic plate small, only 3 mm. across, and situated only 7 or 8 mm. from centre of disk.

Adambulacral plates short and numerous; each bears a pointed spine, deep in the furrow, and two blunt spines on the furrow margin; these two spines are 1.5-2 mm. long, about .5 mm. wide and are somewhat flattened; the aboral is a trifle smaller and stands further back from the furrow margin. Oral plates each with four marginal spines similar to those of the adambulacral plates, but somewhat larger.

Actinal surface with numerous papulae everywhere. Actinal intermediate areas without spines. Opposite the fifth adambulacral plate, there begins a very distinct series of small sharp spines which runs to the tip of the ray. The fifth adambulacral spines are 5 mm. from the first spine of this series, but at the tip of the ray the distance between the two series is little more than a millimetre. The whole starfish is covered by a skin which is particularly thick and noticeable orally. On the basal half of the arms, very distinct furrows run out at right angles to the long axis of the ray between the adambulacral plates for some distance beyond the actinolateral series of spines just described. In the dry specimen these furrows are very conspicuous because of their lighter colour. There are of course no pedicellariae.

Colour of dry specimen, reddish-brown. In life the colour is said to have been purple.

Between Fremantle and Geraldton, W.A. One specimen, No. 4918. Type.

If we are to distinguish *Othilia* as a separate genus from *Echinaster*, on account of the actinal papulae, then this species belongs to *Othilia*, for the actinal papulae are a very noticeable feature. But the type of *Othilia* is *Edhinaster spinosus* of Brazil, and the present species does not resemble that species in general appearance so much as it does some of the East Indian *Echinasters*. For the present therefore, I have concluded to ignore *Othilia* and describe this specimen as an *Echinaster*. It does not seem to be very closely related to any of the previously known species, but it must be granted that *Echinaster* is a perplexing genus and specific differentiation is not very complete within it. Individual variation



is considerable and there are few characters which seem well to separate the species. A revision of the described species is much needed.

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## ECHINASTER VESTITUS.

*Ophidiaster* (?) *vestitus*, Perrier, 1869. Arch. Sci. Nat., vol. 12, p. 254.  
*Echinaster vestitus*, Perrier, 1875. Arch. Zool. Exp., vol. 4, p. 372.

This specimen has been compared with specimens from Mauritius and Zanzibar labelled *vestitus* by Perrier himself, but owing to its poor condition, due to a peculiar scurfy encrustation all over the surface, I am not wholly satisfied that it is identical with them. There are 5 rays about 120 mm. long, and nearly 20 mm. in diameter at base; they are nearly cylindrical but taper somewhat to a blunt point; 1—16 mm. The abactinal surface and sides of the rays are covered with papulae and numerous small spines, while the skeleton itself is pretty well concealed by the overlying skin. The spinelets are rarely a millimetre long. The adambulacral plates carry only two spines each, one deep in the furrow and a larger blunt, or even slightly clavate spine on the margin. Papulae are not present below what seems to be an inferomarginal series of spines: between this series and the adambulacrals there is a more or less well-marked series of somewhat smaller actinolateral spinelets. Colour, bright yellow-brown.

Off Port Hedland, W.A. One specimen, No. 4031.

The peculiar encrustation on this specimen prevents a satisfactory study of its characters. The nature of this encrustation I have not been able to determine, but it appears to be organic.

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## PLECTASTER DECANUS.

*Echinaster decanus*, Müller and Troschel, 1843. Arch. f. Naturg. Jhrg. 9, vol. 1, p. 114.  
*Plectaster decanus*, Sladen, 1889. *Challenger Asteroids*, p. 535.

The occurrence of this species on the south-western coast of Australia is not surprising, though it is a considerable extension of its known range.

Albany, W.A. One specimen, in poor condition. No. 4859.

## ASTERIAS CALAMARIA.

Gray, 1840, Ann. Mag. Nat. Hist., vol. 6, p. 179.

This species has not been recorded from West Australia hitherto, though its occurrence there is quite to have been expected if Gray's original specimens were really from such widely separated places as Mauritius and Australia.

No data. One specimen, No. 133.

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## ASTERIAS POLYPLAX.

*Asteracanthion polyplax*, Müller and Troschel, 1844. Arch. f. Naturg. Jhrg. 10, vol. 1, p. 178.

*Asterias polyplax*, Perrier, 1875. Arch. Zool. Exp., vol. 4, p. 327.

This is one of those perplexing starfishes, which it is almost impossible to distinguish from *Asterias*, in a broad sense, and which nevertheless seems to belong in the Stichasteridae if that family is to be recognised. As I very much question the validity of this latter family, it seems to me better to keep *polyplax* in the genus *Asterias*, until that assemblage of species is properly broken up into its component parts. As both Verril and Fisher are now at work on this problem, the name *Asterias polyplax* may well be used for a few years more for the present Australasian species.

Between Fremantle and Geraldton, 80-120 fms. One specimen, No. 4917.

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## OPHTUROIDEA.

Although four of the nine species of ophiurans appear to be undescribed and one of these requires the formation of a new genus, the collection from the Western Australian Museum is remarkable for what it does not contain, to nearly as great a degree as for what composes it. The ophiurans of West Australia have recently been the subject of a paper by Koehler<sup>1</sup> based on the collection made by Michaelsen and Hartmeyer in 1905. That collection contained 28 species, of which only three were considered as previously undescribed; one of these was an Ophiacantha and the other two belonged to Ophiothrix, both large, diversified and widespread genera. A fourth species was subsequently described as new by Döderlein<sup>2</sup>, an astrophyton of the genus Astroboa. Of the 28 species, only 3 are in the collection before me. Of the 14 genera collected by Michaelsen and Hartmeyer, only 4 are in this collection; such common genera as Amphiura, Ophiactis, Ophionereis, Ophiocoma and Ophiacantha are entirely unrepresented. On the other hand the two collections contrast with each other sharply in the fact that only one of Michaelsen's and Hartmeyer's species was a Euryalid while five of the nine species before me represent that group. It would be hard to collect two series of Ophiurans from the same region which would differ more strikingly from each other than do the two under discussion. Nor is it easy to suggest any reason for such an extraordinary difference. Possible further studies, made on the ground, may explain the matter.<sup>3</sup>

## PECTINURA DYSCRITA.

H. L. Clark, 1909. *Thetis* Echinoderms. Mem. Aust. Mus., vol. 4, p. 534.

This species, previously known only from New South Wales, is represented by a single specimen in poor condition.

Between Fremantle and Geraldton, W.A. One specimen, No. 4929.

<sup>1</sup> Koehler, 1907. Die Fauna Südwest-Australiens; Ophiuroidea, vol. 1, pp. 241-254.

<sup>2</sup> Döderlein, 1911. Über japanische und andere Euryalae, p. 82.

<sup>3</sup> The explanation of the difference between these two collections appears to be simple. The collection sent to Mr. Clark was entirely composed of specimens trawled by the *Endeavour*, chiefly in depths approaching 100 fathoms. Drs. Michaelsen and Hartmeyer obtained their specimens by dredging in comparatively shallow water in sheltered localities.—W. B. A.

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OPHIOTHRIX SPONGICOLA.

Stimpson, 1855. Proc. Acad. Nat. Sci. Philadelphia, vol. 7, p. 385.

This is another of the New South Wales species, which might naturally be expected in West Australian waters. For an account of its more recent history see *Thetis* Echinoderms, Mem. Aust. Mus. vol. 4, p. 546.

Between Fremantle and Geraldton, W.A. One specimen in poor condition. No. 4930.

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OPHIOTHRIX STELLIGERA.

Lyman, 1874. Bull. M.C.Z., vol. 3, p. 237.

This species, which was taken by Michaelsen and Hartmeyer at five stations, is represented by a rather large specimen, with disk 8 mm. across, and the most nearly complete arm from 32-35 mm. long. It is in fairly good condition. It seems to have been taken with the previous species, as it was in the same vial and bears the same catalogue number.

Between Fremantle and Geraldton, W.A. One specimen, No. 4930.

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OPHIOMYXA AUSTRALIS.

Lütken, 1869. Add. ad Hist. Oph., pt. 3, p. 45.

This is the second of the three species in this collection, which were also taken by Michaelsen and Hartmeyer; they found it at four stations. It was also taken by the *Thetis* and by the *Challenger*, so it may naturally be considered one of the commonest Australian brittle stars.

Between Fremantle and Geraldton, W.A. One specimen in poor condition, No. 4928.

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ASTROGYMNOTES,<sup>1</sup> gen. nov.

Disk and arms covered with a skin, which apparently contains no calcareous plates, except numerous rounded granules on the upper surface of the arms. No radial shields on upper or under arm-plates are visible. No madreporite. Teeth well developed, but oral papillæ rudimentary. Arm spines and tentacle scales both present and easily distinguishable from each other.

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<sup>1</sup> Gr. *aster*—a star; *gymnotes*—nakedness, in allusion to the absence of plates on disk and arms.

Type species, *Astrogymnotes catasticta*, sp. nov.

This interesting new ophiuran, noticeable for being jexamerous, appears to be one of the sub-family *Astroscheminæ* as restricted and defined by Doderlein in 1911. But it is easily distinguished from the other members of that family by the absence of both upper and under arm plates, and the presence of both tentacle scales and arm spines.

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## ASTROGYMNOTES CATASTICTA,<sup>1</sup> sp. nov.

PLATE XXII.

Rays 6, rarely 7. Disk about 9 mm. across; rays about 45 mm. long. Entire animal covered by a smooth skin, which is perfectly bare, except on the upper surface of the arms and the adjoining portions of the disk, where it is more or less crowded with minute circular bits of lime; about a dozen series of these occupy the width of the arm. Radial shields not visible but indicated through the skin by short radial elevations, a pair at the base of each arm; these are about 3 mm. long. No upper or under arm-plates to be seen even in a dried specimen. Teeth well formed, in a vertical series of five; oral papillae rudimentary, about three on each side of each jaw. No madreporic or oral shields present. Arm-spines present, one on each of the three basal segments, but two on each of the remaining segments; they are less than a millimetre long, cylindrical, blunt and subequal. Tentacle-pores evident, each one guarded by a flat, nearly circular tentacle scale. Genital slits small and oblique, about equal to the length of an arm-joint; two in each interradius. Colour yellow-brown, indistinctly speckled on radial areas of disk, and conspicuously spotted all over the lower surface of disk and arms with pale yellowish white. In dry specimens the colours are dull, the spotting is not so noticeable and the calcareous granules give the upper surface of the arms a whitish cast.

Off Jurien Bay, W.A., 80-100 fms. Ten specimens, No. 4,924.

It is a real satisfaction to have such a good series of this remarkable ophiuran for study. It is probably as nearly related to *Astroschema* as to any known genus, but still retains a distinction between arm spines and tentacle scales. The arms are also

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<sup>1</sup> GR. *catastictos*—spotted.

relatively much shorter than is usual in that genus. Several of the specimens show by their unequal development that reproduction by fission is normal for the species.

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### OPHIOCREAS MELAMBAPHES,<sup>1</sup> sp. nov.

Rays 5. Disk about 6.5 mm. in diameter, with arms about 120 mm. long and 2 mm. thick. Entire animal covered with a thick smooth skin, through which, in dried specimens, the radial shields and side arm-plates are revealed. The radial shields are about 3 mm. long by one mm. broad, and are perfectly smooth, though slightly swollen. There are no calcareous granules in the skin of the dorsal surface on either disk or arms. Teeth 4 or 5, the lowest often displaced and somewhat deformed. Oral papillae wanting. No oral shields or madreporite. First two pairs of the very small tentacle-pores bare, but all subsequent pores guarded by two spine-like tentacle-scales of which the inner is a trifle the longer and is about half a millimetre long. Genital slits very small, less than a millimetre long, oblique, crescentic; two in each interbrachial space.

Colour, deep purple or purplish black above and on sides, but actinal surface of disk and arms dull cream colour.

Off Jurien Bay, W.A., 80-100 fms. Two specimens, No. 4,925.

The smaller specimen is the Type.

Although this species resembles *O. silogae*, Koehler, in many characteristic features, it is distinguishable from that species at a glance by its different proportions, different tentacle-scales and strikingly different colour. Döderlein does not consider the character by which *Astroschema* differs from *Ophiocreas* sufficiently constant to warrant the maintenance of the two genera, but I am inclined to think that while our definitions will need to be readjusted, the two groups had better be retained. The present species is a typical *Ophiocreas* so far as its external covering is concerned.

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<sup>1</sup> GR. *melambaphes*—dark-dyed.

## OPHIOCREAS RHABDOTUM,<sup>1</sup> sp. nov.

Rays 5. Disk 5 mm. in diameter, with arms about 78 mm. long. Very similar to the preceding species, but arms shorter and more slender, radial shields shorter and less prominent and teeth sharper and more regular. Only the first pair of tentacle-pores lacks tentacle-scales.

Colour dull yellow, speckled and streaked on disk with blackish: a broad blackish stripe runs the length of the arm in the median line abactinally, but under the lens, even this stripe is found to be finely speckled with yellowish; just above the tentacle-scales there is on each side of the arm, a very narrow and often indistinct blackish stripe.

Off Jurien Bay, W.A., 80-100 fms. Two specimens, No. 4,926.

The larger specimen is the Type.

As this form was taken at the same station with the preceding, I think it quite possible that it is only a colour phase of that species. But the colour difference is so marked, and the two specimens of each species are so distinctly characterised thereby, I have felt it was more satisfactory to designate them by different names. Further investigation on the West Australian coast is necessary for a correct settlement of the question.<sup>2</sup>

## CONOCLADUS MICROCONUS.<sup>3</sup> sp. nov.

PLATE XXV.

Rays 5, but in the type specimen there are 6. Disk, 35 mm. in the type, in the smaller specimen 27 mm. in diameter, with arms about 90 or 100 mm. long and 10 mm. wide at base; height of arm near disk, 5-6 mm. Radiating wedges of disk separated from each other by five (in the type, six) narrow deep grooves, which are

<sup>1</sup> Gr. *rhabdotos*—striped.

<sup>2</sup> The two supposed species of *Ophiocreas* were obtained together in large quantities attached to one particular species of Hydroid, with which their arms were so much intertwined that it was very difficult to remove them, except in fragments. Whilst I entered them under two numbers, I made a note at the time that they were "probably colour varieties of one species"—W. B. A.

Gr. *mikros*—little; *konos*—cone; in reference to the small size of the cones on the disk.



practically filled up by the small, rough cones of the disk plates. Each wedge is covered by a rough, uneven pavement of plates, grains and granules, rarely smooth, but usually bearing a ridge, lump or small cone. These cones are of very diverse sizes and shapes; they are rarely a millimetre high and are very seldom pointed; they commonly terminate in a group of 3-15 little spinules. This irregular and very rough pavement extends out on the area so that there is no line of division between the latter and the disk. None of the cones are enlarged nor have they any definite arrangement. The arms branch about eight times; the first division being about 22-27 mm. from the disk; the resulting branches after each division are often very unequal. Beyond the second fork the branches become long and very slender and are covered by alternating paired half-circles of granules and glassy hooklets. Oral surface of disk and arms covered with small roundish flat granules, most numerous on the mouth angles and bases of the arms. Tentacle-pores small; first pair (not counting buccal tentacles) well within disk, with no tentacle-scales. Each succeeding pore is more or less concealed by a slight ridge on its adoral side, which carries 4 (rarely 3 or 5) short, slightly curved peg-like spines, rather more than half a millimetre long. Each spine is compressed and its terminal margin divides into 3-5 little glassy spinelets. Each mouth angle carries a cluster of twenty or more spiniform teeth and similar but shorter papillae. Genital slits small, hardly 2 mm. long, and more or less concealed. Madreporic plate distinct, hardly 2 mm. across.

Colour, uniform light brown; in life, "dull brown."

Between Fremantle and Geraldton, W.A., 80-120 fms. Two specimens, No. 4921.

The larger specimen, although 6-rayed, is selected as the Type.

The occurrence of a new species of *Conocladus* in West Australian waters is most interesting, the two previously known species having been reported only from New South Wales. As Döderlein (1911, *Über Japanische und andere Euryalae*, p. 68) has pointed out *Conocladus* is in certain respects a very primitive form mostly nearly allied to *Astroconus australis*, Verr. This discovery of a third well-marked species would seem to indicate that Australia is emphatically the home of these primitive Eurylids and even suggests that it may have been the ancestral home of the whole order.

The West Australian species is very easily distinguished from its New South Wales congeners by the entire absence of large cones or tubercles on the disk.

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## ASTROBOA ERNAE.

Döderlein, 1911. Über japanische und andere Euryalae, p. 82.

It is interesting to find specimens of this species in the collection since it was hitherto known only from the holotype, a specimen 22 mm. across the disk. One of the present specimens is only 15 mm. across the disk while the others are nearly 40. But I have nothing to add to Döderlein's careful description. The colour of these individuals in life is said to have been "buff or leaden." In alcohol, they are a peculiar shade of purplish brown, which is hard to name. On drying, they become very light, almost a dirty white, with a purplish cast.

Off Geraldton, W.A., 29 fms. Three specimens, No. 4923.

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## ECHINOIDEA.

Although the collection of Echini is remarkable for the large number of species it contains, yet eleven species which were in the *Thetis* collection from New South Wales are not represented here. Several of these are common littoral forms of wide distribution and will probably be found hereafter on the West Australian coast. As already noted, four and possibly five of the nineteen species are new to science, and belong in groups of more than usual palaeontological interest.

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## PHYLLACANTHUS MAGNIFICUS,<sup>1</sup> sp. nov.

PLATE XXVI.

Test nearly spherical, 92 mm. in horizontal diameter and 72 in vertical; hence v.d.=.78 h.d. Longest primary, about 75 mm. in length, 10 mm. in diameter near base and 5 mm. in diameter at tip. Interambulacral plates 10 in each column, all, except sometimes, the uppermost with a long, stout primary spine. Interambulacra

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<sup>1</sup> The origin and significance of this name are obvious.

43 mm. wide; ambulacra nearly 13 mm.; hence interambulacra more than three times as wide as ambulacra. But median interambulacral space only 11 mm. wide, and hence only one-fourth of interambulacrum. Median ambulacral area less than 6 mm. wide, and hence less than half the ambulacrum. Abactinal system 28 mm. in diameter and actinostome the same.

Genital plates moderately large, about 11 mm. wide by 7 mm. high, but madreporic genital very large, nearly 16 mm. wide by 11 mm. high. Oculars small and low; ocular V insert, and I nearly so; in the smaller specimen, all the oculars are exsert but V is nearly in. Genital pores large, near centre of plate, surrounded by a circle of about a dozen broad flat spinelets larger than the others on the plate; as these spines are closed over the pores, they form a conspicuous conical elevation. Ocular pores small near distal margin of plate. Interambulacra, median areas of ambulacra, abactinal system and actinostome, densely covered with small flattened bluntly pointed spinelets and pedicellariae. Secondary spines of interambulacra in circles of 15-20 around the bases of the primary spines; they are broad, flat and truncate, about 8 mm. long by 2 mm. broad. Along the margin of the median area of each ambulacrum is a series of narrow, flat spines, about 4 mm. long and .5 mm. wide, which lie flat across the poriferous areas. Between these marginal series are four or five series of smaller spines or spinelets similar to those on the interambulacra. Pores of a pair rather large wider than high, separated by a space wider than the width of a pore and connected by the groove characteristic of the genus.

Pedicellariae present in great numbers. The tridentate show little diversity in size, but are chiefly actinal in position and on the interambulacra. Their valves are about two millimetres long, but the blade is only about .25 mm. wide, so they are very slender; the valves meet only at or near the tip. There is a single vertical ridge extending the length of the blade in the median line on its inner surface similar to those found in the tridentate pedicellariae of *P. imperialis*, but rather more prominent; it is sharply serrate, more coarsely so than the margins of the blade. The small globiferous pedicellariae are abundant almost everywhere and are very similar to those figures by Mortensen for *P. Imperialis*. Their valves are about .30 mm. long. The large globiferous pedicellariae are very common, particularly on the ambulacra; the valves are .80-.90 mm.

long, but the stalk is little more than half that ; it has no "limb." The valves are shaped very much like those of the small globiferous pedicellariae, but the terminal opening is surrounded by coarse, curved teeth. This opening is very variable in size and form ; it may be less than one-fourth the length of the valve or it may be nearly two-fifths ; it is often of some peculiar shape and not rarely is divided vertically into two openings ; even when the opening is short there is little tendency towards a "snout-like" blade. The large globiferous pedicellariae vary very little in size and do not seem to intergrade at all with the small ones.

Primary spines very stout, rough with small rounded granules, which soon become more or less completely concealed by a spongy alteration in the outer layer of the spine and the profuse growth of bryozoa, sponges and other organisms which cover the old spines. At the tip, the series of rounded granules are arranged longitudinally and pass into ridges which surround the blunt end of the spine. Young spines are bluntly pointed but become more and more flaring with age and the actinal primaries are particularly notable for their stoutness and flaring tips. The thickness of some of these at tip may be equal to one fourth or even almost one-third the total length of the spine. There are 24-36 longitudinal ridges around the tips of the larger primaries. The collar is low, seldom over 3 mm. in height.

Colour, deep red-brown, so far as secondaries, miliaries and pedicellariae are concerned ; young primary spines yellow-brown, but rapidly darkening with age ; the collar remains yellow-brown throughout life, but the rest of the spine, where not covered by foreign growths, has a marked purplish-red shade.

Between Fremantle and Geraldton, W.A. Two specimens, No. 4935. The larger is the Type.

The type specimen of this fine new species is one of the largest and most perfectly preserved cidarids I have ever seen. The other specimen is 75 mm. h.d. and 51 v.d., so that v.d. is little more than .66 h.d. There are 8 or 9 interambulacral plates in each column. In other particulars the specimens differ little from each other. While the relationship to *imperialis* is obvious, this species is easily distinguished by the remarkable actinal primaries and the large number of coronal plates. To no other of the Recent species of the genus does it show any close relationship.

## PHYLLACANTHUS ANNULIFERA.

*Cidarites annulifera*, Lamarck, 1816. Anim. s. Vert., vol. 3, p. 57.  
*Phyllacanthus annulifera*, A. Agassiz, 1872. Rev. Ech., Pt. 1, p. 150.

There is a beautiful cidarid in the collection which seems to belong to this species although the coloration is different from that of any *annulifera* I have seen. The test is 30 mm. i.d., and the primaries, which are very thorny and quite free from foreign matter are about 40-45 mm. long; the collar is 4 mm. high. The ocular plates are all insert, but II and III are only barely so.

The test is cream-colour, or almost pure white on the bare median ambulacral area; the miliary and secondary spines are almost white, or at least very light coloured, with a broad longitudinal stripe on their upper (or outer) surface of bright brown, which is darkest on the smallest spines and palest on the largest; actinally the brown is almost brownish-red. The primary tubercles and the collars of the primaries are bright pinkish lavender. The primary spines are light coloured with a markedly greenish cast, and with almost eight bands of dull purplish-red; these bands are broken on the sides of the spine and are faint on the lower surface; the thorns on the actinal primaries are red, often with white tips, and the primaries close to the actinostome have the entire tip red.

Port Hedland, W.A. One specimen, No. 4026.

## TRETOCIDARIS BRACTEATA.

*Dorocidaris bracteata*, A. Agassiz, 1879. Proc. Amer. Acad., vol. 14, p. 197.  
*Tretocidaris bracteata*, H. L. Clark, 1907. Bull. M.C.Z., vol. 51, p. 206.

These specimens are larger than any previously known, having h.d.=35 mm. The primaries are 50 mm. or more in length, and are 4 mm. broad near the base; they are somewhat flattened there and the longitudinal ridges are very prominent; these latter are broken up into flattened truncate or sharp teeth, making the spines conspicuously and coarsely rough. The collar on the primaries is very low, which is one of the best characteristics of the species. Another useful character is the spotting of the primaries, at least near base, with longitudinal series of red-brown dots. The pink secondary spines are also a noticeable character, those of the inter-ambulacra in these specimens being evidently tipped with yellowish. The large globiferous pedicellariae are very uncommon but are to

be found abactinally. The heads are less than a millimetre in length, but the stalk is nearly two millimetres; the latter has a conspicuous "limb," the branches of which are about .2 of a millimetre long. The valves resemble closely those of *T. affinis*. The tridentate pedicellariae are very slender, the valves, which are hardly .05 mm. wide, range from .9 to 1.25 mm. in length and meet only near tip. The small globiferous pedicellariae have valves ranging from .25 to .55 mm. in length and are provided with an end tooth.

Between Fremantle and Geraldton, W.A., 60-100 fms. Two specimens, No. 4,933.

The occurrence of this distinctly East Indian species off West Australia is notable and hardly to be expected. These large specimens bear a striking superficial resemblance to *Phyllacanthus annulifera*, but even hasty examination distinguishes them. The low collar and the red-brown spots, not to mention the pedicellariae, are sufficiently marked differences to be obvious to even a casual observer.

## GONIOCIDARIS TUBARIA.

*Cidarites tubaria*, Lamarck, 1816. Anim. s. Vert., vol. 3, p. 57.  
*Goniocidaris tubaria*, Lütken, 1864. Vid. Med. f, 1863, p. 137.

The occurrence of this species on the west coast is interesting, even though the specimens are small (20 mm. h.d.).

Between Fremantle and Geraldton, W.A., 100 fms. Two specimens, No. 4,938.

## CENTROSTEPHANUS TENUISPINUS,<sup>1</sup>

sp. nov.

PLATE XXVI.

This species is so nearly related to *C. rogersii* of New South Wales that an extended description would be superfluous. The test is essentially alike in the two species, but there are more coronal plates in the one from West Australia. The actinostome is noticeably smaller and the abactinal system is somewhat larger. Thus in an eastern specimen, 84 mm. h.d., there are 16 interambulacral plates in each column, the actinostome is 36 mm. across and the abactinal system is 18 mm., while in a western specimen of the same size, there are 18 interambulacral plates in each column, the

<sup>1</sup> GR. *tenuis* = slender + *spinus* = a spine.



actinostome is 32 mm. across and the abactinal system is 24 mm. When other adult specimens (*i.e.*, over 60 mm. L.d.) are taken into account, we find that these differences sum up to about this; in the eastern species the abactinal system is .50-.60 of the actinostome, while in the western form it is .65-.75. The most obvious character of the new species, however, is seen in its slender spines; the largest primaries are from 1.3 to 1.6 mm. in diameter where thickest (near base) and as they are 75-80 mm. long, they appear very slender as compared with *rodgersii*; in *rodgersii* the primaries are 2-3 mm. in diameter, at least near base, and seldom exceed 75 mm. in length. This difference in the primary spines gives the two species totally different facies. There is also a noticeable difference in colour, in the specimens I have seen, though it may not prove a constant one; in *rodgersii*, the colour is more or less purple, sometimes almost black, again deep crimson rarely brownish-red; in *tenuispinus*, the colour is reddish-brown or dull greenish, with no trace of purple.

The pedicellariae in the two species do not seem to differ except in relative frequency. Thus in specimens of *rodgersii*, slender tridentate pedicellariae seem to be very rare. Mortensen did not find them, and I have only found one on six specimens from New South Wales. But in *tenuispinus* they are very common all over the test and the valves may exceed 3 mm. in length. On the other hand, the stout tridentate pedicellariae with curved valves seem to be rather uncommon in *tenuispinus*.

Between Fremantle and Geraldton, W.A. Two specimens, No. 4,936. The light-coloured one is the Type.

It is of course possible that larger series of specimens than are available to me, will show that this supposedly new species is only a form of *rodgersii*, but the general appearance is so different, I have little hesitation in giving it a new name. And I am confirmed in this by finding that the specimens of *C. rodgersii* recorded by A. Agassiz (Rev. Ech. pt. 1, p. 98) from "Houtman's Abrolhos" are the slender spined western form and not typical *rodgersii*; at any rate this is true of the specimen in the M.C.Z. collection. This specimen is young (only 47 mm. h.d.) but when compared with a specimen from Port Jackson, 43 mm. h.d., its smaller actinostome and its much more slender primary spines are noticeable.



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SALMACIS ALEXANDRI.

Bell, 1885. Proc. Linn. Soc. N.S.W., vol. 9, p. 505.

A very fine specimen of this species is in the collection from off Geraldton, W.A., 29 fms., No. 4932. It is deep rose-purple, the spines tipped with white.

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## SALMACIS SPHAEROIDES.

*Echinus sphaeroides*, Linne, 1758. Sys. Nat. ed. 10, p. 664.

*Salmacis sphaeroides*, Lorén, 1887. Ech. Linn. p. 69.

There are two fine specimens (Nos. 4027 and 4028) from Port Hedland, W.A.; in one the test has a greenish cast and the bases of all the spines are conspicuously dark green, in the other the green colour is confined to the spine bases and is reduced to a minimum there; as a result of this seemingly slight difference the specimens look quite unlike.

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## TEMNOPLEURUS, sp. ?

There are a couple of bare tests of a temnopleurid (No. 5007) in the collection, with no data other than that they are from Fremantle Beach, West Australia, which cannot be referred to any known species. I think they undoubtedly represent a temnopleurus and probably an undescribed species, but I cannot see that anything is gained by giving them a name. They are 24 or 25 mm. h.d. and 13 or 14 v.d. The colour is dull green, with the median ambulacral and interambulacral areas cream-colour, gradually widening actinally, so that the whole lower surface is of that light shade. The base of one primary spine remains attached to the test, and it is pale red in colour. Until the spines and pedicellariae can be examined, this species may well be nameless.

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## AMBLYPNEUSTES GRANDIS.

H. L. Clark, 1912, Mem. M.C.Z., vol. 34, p. 329.

There is a single specimen (No. 4932) in the collection. It is about 60 h.d. and has lost most of its spines. It is from off Geraldton, 29 fms.

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AMBLYNEUSTES GRISEUS.

*Echinus griseus*, de Blainville, 1825. Dict. Sci. Nat. Oursin, vol. 37, p. 81.

*Amblyoneustes griseus*, L. Agassiz, 1841. Intro. Mon. Scut., p. IX.

A rather small specimen (No. 5008) of this species is in the collection. From Fremantle Beach, W.A.

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## HOLOPNEUSTES POROSISSIMUS.

L. Agassiz and Desor, 1846. Ann. Sci. Nat. (3) vol. 6, p. 364.

A specimen from Fremantle Beach, bearing the same number as the specimen of the preceding species from the same place (viz. 5008), proves to be one of this species.

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## HELIOCIDARIS ARMIGERA.

*Strongylocentrotus armiger*, A. Agassiz, 1872. Bull. M.C.Z., vol. 3, p. 55.

*Heliocidaris armiger*, H. L. Clark, 1912. Mem. M.C.Z., vol. 34, p. 350.

Although the primary spines in these specimens are not quite so stout as in the type specimen, they are sufficiently so to distinguish them at a glance from their nearest ally, *H. erythrogramma*. None of the specimens is large (h.d. ranges 25-38 mm.) but all seem adult. The longest primaries do not exceed 15 mm., and their thickness is from 1.5 to 2 mm.

Fremantle Beach, W.A. One specimen, No. 5006.

Fremantle, W.A. One specimen, No. 149.

Cottesloe Beach, W.A. One specimen, No. 5036.

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## HELIOCIDARIS ERYTHROGRAMMA.

*Echinus erythrogrammus*, Valenciennes, 1846. Voy. Venus., Zooph. pl. VII, fig. 1.

*Heliocidaris erythrogramma*, L. Agassiz and Desor, 1846 (3) Ann. Sci. Nat., vol. 6, p. 371 (*erythrogrammus* *lap. cal.*)

Although these specimens are a little larger than those of *armigera*, the spines do not exceed 15 mm. in length, but few of them are as much as 1 mm. in thickness, so that they seem longer than they are. There are no data with the two specimens, but they bear the numbers 171 and 179, and are said to be from West Australia.

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## ECHINOMETRA MATHIAEI.

*Echinus mathaei*, de Blainville, 1825. Dict. Sci. Nat. Oursin, vol. 37, p. 94.

*Echinometra mathaei*, de Blainville, 1830. Dict. Sci. Nat., Zooph., vol. 60, p. 206.

The two specimens of this very common and widely distributed sea-urchin have no data with them. They bear the numbers 165 and 167 and are said to be from West Australia.

CLYPEASTER TELURUS,<sup>1</sup> sp. nov.

PLATE XXIII.

Test broadly oval, widest posteriorly, very flat, 96 mm. long, 89 mm. wide and 13 mm. high ; its breadth is thus nearly .93 of its length, while its height is less than .14. Test thin and fragile, its margin only 3 mm. thick. Abactinal system at centre of test, but the latter slopes more abruptly posterior to the apex than it does anteriorly or laterally. Posterior interr radial margin distinctly depressed below posterior radial margins. Lower surface slightly but very uniformly concave : the slope begins very near or at the margins and the mouth which is perfectly central, is nearly 4 mm. below (*i.e.* above, of course !) the lateral margins. Petaloid area 49 mm. long and 24 mm. wide. Anterior or unpaired petal 26 mm. long, 12 mm. wide, rather broadly open at distal end, the converging poriferous areas each about 2 mm. wide. Anterolateral petals 22 mm. long, 11 mm. wide, and nearly closed (open by 1 mm.) poriferous area about 2 mm. wide. Posterolateral petals 23 mm. long, 12 mm. wide, well open (by 3 mm.): poriferous area 2 mm. wide. Ridges between pore-pairs of unpaired petal, each with a single series of six or more primary tubercles. Median area of petals not at all abovate but as wide at middle as anywhere. Anal system, trigonal with rounded angles or oval, about 4.5 mm. broad by 3.75 mm. long ; its distal margin 10 mm. from distal margin of test, or more than .20 of the long radius. Madreporic body small, only 2.5 mm. across. Genital and ocular pores indistinguishable. Auricles well developed, well separated.

Abactinal primary spines very small. Scarcely a millimetre long, thickened at tip. Actinal primaries 3 mm. long (those about mouth 4 mm.) terete and bluntly pointed. Miliary spines minute and abundant, slightly thickened at tip. Pedicellariae rather scarce, except around mouth and anus where tridentate are fairly common. Valves of tridentate rather stout, the blades broad, meeting only at tip ; in the largest ones seen the valves are about .30 mm. long. Ophicephalous pedicellariae very scarce, small but not peculiar.

Colour of test, abactinally, dull purplish brown of a light shade ; actinally the test has a slight greenish cast ; abactinal spines under

<sup>1</sup> Gr. *telouros*—remote ; in reference to the unusual distance of the anal system from the margin of the test.

a lens, nearly white; actinal spines whitish, the largest ones with a faint broad band of purplish, near middle.

Between Fremantle and Geraldton, W.A. One specimen, No. 4937. Type.

This interesting new species is in many particulars like *C. rotundus*, A.Ag. from the west coast of Mexico and Central America, but there are some important differences. Chief of these is the position of the anus which in *rotundus* is rarely more than 3 mm. from the margin of the test. In *rotundus*, too, the poriferous areas of the petals are much wider in specimens of the same size; thus in a specimen of *rotundus* of the size of the *telurus* above described, the poriferous area would be about 3 mm. wide, or nearly 50% broader. The test is much more fragile and the margin is thinner in *telurus* than in *rotundus*.

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## PERONELLA APHNOSTINA<sup>1</sup> sp. nov.

### PLATE XXIV.

Test somewhat elongated, abruptly narrowed posterior to middle, very flat, finely and evenly granulated; length 137 mm.; greatest breadth, slightly anterior to mouth, 112 mm.; breadth equals less than .82 of length; 15 mm. back of mouth, width is only 95 mm. and 30 mm. back of mouth it is only 88 mm.; at anus, it is 55 mm. Apex of test coincides with centre of madreporic body, 64 mm. from anterior margin of test. Mouth directly beneath apex. Apical-oral diameter, 13 mm. Test thinnest at margin where it is scarcely 3 mm. thick. Oral surface flat; mouth scarcely at all sunken. Auricles fused into a single stout piece on each interambulacrum. Anal system small, about 4 mm. in diameter, its distal margin about 6 mm. from test margin; it is covered with small spine bearing plates.

Petaloid area, about 72 mm. long and 68 mm. broad. Anterior or unpaired petal, 36 mm. long; antero-lateral, 32 mm.; postero-lateral, 37 mm. Each petal is about 10 mm. wide. Unpaired petal broadly open (by 4.5 mm.); paired petals open by about 3 mm. Madreporic body about 4 mm. across. Genital pores 4, there being none in posterior interradius. Primary spines 3-4 mm. long actin-

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<sup>1</sup> GR.=*Aphno*, of a sudden+*steino*=to make narrow, in reference to the shape of the test.

ally, much smaller abactinally, terete, nearly smooth, those about mouth stoutest. Miliary spines minute, abundant, similar to those of *P. lesueurii*. Pedicellariae very scarce; the single tridentate that was found, was similar to those of *lesueurii*.

Colour abactinally, light reddish brown; the red is very marked when the test is moistened; actinally the colour is more yellow-brown.

Carnac Island, near Fremantle, W.A., Dec. 11, 1909. One specimen, No. 3936. Type.

I have been greatly in doubt as to whether this specimen represents a new species or is a peculiar individual variant of *P. lesueurii*, Agass. Comparison with numerous specimens from Queensland and from the East Indies has failed to satisfy my doubts, but as *lesueurii* has hitherto been found only on the eastern coast of Australia and does not reach so far south as Bass Strait, I have decided to give this West Australian specimen a new name indicative of its strikingly peculiar shape. Compared with a specimen of *lesueurii* from Queensland, of the same length, the following peculiarities are noted:—

1. The test is remarkably narrow; its greatest width is not much over 80 % of its length, while in *lesueurii* it is distinctly over 90 %.
2. The test is abruptly narrowed back of the mouth; its width 30 mm. back of mouth is less than 65 % of its length while it is more than 78 % in *lesueurii* at the same point.
3. The petals are shorter, wider and much more open at the tip; in *lesueurii* the petals are open only 1 mm. or less.
4. The test is thinnest at the margin; in *lesueurii* the test is a trifle swollen at the margin and is thinnest several millimetres proximal to margin.
5. The test seems to be more finely and uniformly granulated than in *lesueurii*.

While the last three of these characters are certainly more or less variable in *lesueurii*, and hence of doubtful value, the combination of the five in this Carnac Island specimen gives it a general appearance totally unlike that of any *Peronella* I have ever seen. The collection of a few more specimens on the West Australian coast would show whether *aphnostina* is a valid species or not.

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LINTHIA AUSTRALIS.

*Desoria australis*, Gray, 1851. Ann. Mag. Nat. Hist. (2), vol. 7, p. 132.

*Linthia australis*, A. Agassiz, 1872. Rev. Ech. pt. I, p. 138.

A single bare test (No. 5005) from Fremantle Beach shows that this is a West Australian species, although it was previously known only from South-western Australia and Tasmania. It is still a rarity in Museums and specimens with spines are greatly to be desired.

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## ECHINOCARDIUM AUSTRALE.

Gray, 1851. Ann. Nat. Hist. (2), vol. 7, p. 131.

It is not at all surprising to find this widely distributed species in the collection.

Safety Bay, W.A. Three specimens, Nos. 239, 240, 241.

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## BREYNIA AUSTRALASIAE.

*Spatangus australasiae*, Leach, 1815. Zool. Misc., vol. 2, p. 68.

*Breynia australasiae*, Gray, 1851. Ann. Mag. Nat. Hist. (2), vol. 7, p. 131.

The larger of these bare tests (No. 4562) measures 120 mm. long, by 100 mm. wide and 60 mm. high, showing that *Breynia* grows to a larger size than has hitherto been known. Although these specimens differ from those taken at Lord Howe Island, N.S.W., by the very characters on which Gray based his *Breynia desorii*, other specimens in the M.C.Z. collection are intermediate and I do not feel satisfied that *desorii* is a valid species.

Abrolhos Islands, W.A. One specimen, No. 4562.

Fremantle Beach, W.A. One specimen, No. 5004.

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HOLOTHURIOIDEA.

The holothurians unfortunately are not in nearly as good condition as the dry echinoderms, and it is impossible to identify one-third of them. They seem to have been in formalin and several are more or less decalcified. Nevertheless all are of interest for we have hitherto known almost nothing of the holothurians of the western half of Australia—indeed we know little enough of those of the eastern coast. Of the six identified species, three belong to the genus *Pentacta* (= *Colochirus*) and one of these seems to be a remarkable new species, which, should the characters shown by these specimens prove real and constant, might well be given a genus of its own. The other new species is an apodous holothurian of the genus *Caudina*.

CAUDINA TETRAPORA,<sup>1</sup> sp. nov.

Tentacles 15, each with 4 slender, sharply pointed digits, the terminal pair the longer. Calcareous ring well developed, about 2 mm. broad (high); posterior prolongations of radial pieces very conspicuous, nearly 4 mm. long. Stone-canal single, well-developed. Polian vessel single, long and cylindrical. Genital glands rather sparingly dichotomously branched. Respiratory-trees very fully developed. Body not very stout, passing gradually and not abruptly into the tail. The tip of the tail is damaged in both specimens, so the condition of the anal papillae could not be determined. Calcareous particles *knobbed buttons perforated with four holes*

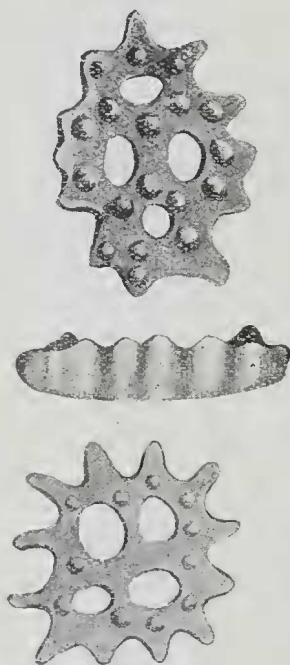
and with more or less conspicuous projections around the margin (text, fig. 1); they are about .1 of a millimetre long. Most of the particles are of comparatively regular form, but more or less variation from the typical condition may be noted; buttons with fewer than four holes are more frequent than those with more.

Colour white or pale brown. Length about 75 mm., of which about one-third is tail; diameter at middle of body 15 mm.: diameter near tip of tail, about 3 mm.

Cottesloe Beach, W.A., July 6, 1912. One specimen, No. 5035. Type.

Abrolhos Islands, W.A. One specimen, No. 229.

This species is readily distinguished from the other members of the genus by its perfectly distinctive calcareous particles. It is no doubt most nearly related to *C. chilensis*, the common New Zealand species, as might have been expected from its geographical propinquity.



TEXT-FIGURE 1.

Calcareous particles from body-wall of *Caudina tetrapora*. x 350.

- a. A typical button seen from the outer surface.
- b. A similar button from the side.
- c. A button with long marginal projections.

<sup>1</sup> GR. *Tetraporos*—having four pores, in reference to the calcareous particles of the skin.



## MOLPADIA, sp. ?

A specimen from Cottesloe Beach [No. 233 (2983)] is in such poor condition that its identification is impossible, but the stout calcareous ring with comparatively short posterior prolongations on the radial pieces is suggestive of *Molpadia* rather than *Caudina*, and the fifteen tentacles and absence of tube-feed, taken in connection with its general appearance, show that it is certainly a *molpadid*. The tail is missing: the remaining body measures about 40 mm. long by 17 in diameter.

## COLOCHIRUS QUADRANGULARIS.

*Holothuria quadrangularis*, Lesson, 1830. Cent. Zool., p. 90.

*Colochirus quadrangularis*, Selenka, 1868. Zeit. f.w.zool., vol. 18, p. 112.

A single specimen, well preserved and about 55 mm. long, but without data, other than "West Australia," is the sole representative of this species.

## COLOCHIRUS TUBERCULOSUS.

*Holothuria tuberculosa*, Quoy and Gaimard, 1833. Voy. de l'Astrolabe, Zool. vol. 4, p. 131.

*Colochirus tuberculosa*, Semper, 1868. Reis. Arch. Phil.: Holothurien, p. 239.

A specimen about 50 mm. long, and without other data than the simple "West Australia," represents this species.

COLOCHIRUS AXIOLOGUS,<sup>1</sup> sp. nov.

PLATE XXV.

Tentacles 10, large and arborescent, the two ventral ones much smaller than the other eight. Calcareous ring only moderately stout, about 3-4 mm. broad (high), with no posterior prolongations, Polian vessel single, rather large and nearly spherical. Stone-canal single, in the dorsal mesentery. Genital glands unbranched, 40-50 mm. long, in a thick tuft on each side of the mesentery, near the middle of the body cavity. Respiratory trees short, but well-developed and much branched. Ambulacral appendages nearly or quite confined to the ventral ambulacra; each of these ambulacra at the middle of the body carries about eight longitudinal series of well-formed, rather large pedicels, the entire band being about 10 mm. wide. As the ends of the body are approached, the series of

<sup>1</sup> Gr. *Axiologos*=remarkable.

pedicels rapidly, almost abruptly decrease to only four or three and then disappear altogether, so that there are no pedicels near either mouth or anus, even in the ventral ambulacra. Dorsal ambulacra (except to some extent near mouth) and all interambulacral areas, entirely free from pedicels or appendages of any kind. Body wall thick (in the type which has been preserved in alcohol, it is 2-3 mm thick) but entirely without calcareous deposits of any kind; a few minute calcareous rods are to be found in the finer branches of the tentacles, and the anus is guarded by five conspicuous calcareous teeth. Interambulacral areas somewhat pointed and projecting at both their anterior and posterior ends, forming valve-like folds which, in the contracted condition, conceal both mouth and anus.

Colour rose-purple, dull in the type and passing into brown on the tentacles, but rather bright in the other specimen, which might perhaps better be described as purplish-rose; in this specimen the tentacles are fully contracted and drawn into the body cavity and the neck-skin thus protected is bright purple, which is perhaps the natural colour of the entire animal in life.

The form of this species is notable and is better shown in the type, which is approximately 90 mm. long. The distance from mouth to anus along the mid-dorsal interambulacrum is however less than 70 mm. while along the mid-ventral ambulacrum it is 210 mm. The girth of the body is 190 mm.

Port Hedland, W.A. Two specimens, Nos. 4032 and 4033. No. 4033 is the Type.

It is difficult to decide whether the absence of calcareous particles in the body-wall is the natural condition or is due to decalcification. The type is so well preserved it is hard to believe it has been decalcified, but the other specimen was preserved in formalin and has the appearance of having been decalcified. If decalcification has occurred artificially it is hard to understand why the anal teeth and calcareous ring should persist apparently uninjured. On the other hand, the species of *Colochirus*, hitherto known, have an excessive amount of calcareous matter in the body-wall and its absence would therefore be an extraordinary specific character, should it prove to be natural and constant. The form of the body in these two specimens and the absence of pedicels on the dorsal surface are also extraordinary characters and should further

collecting produce additional specimens showing essentially the same combination of remarkable features, I should consider the species entitled to separate generic rank.

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### ACTINOPYGA MILIARIS.

*Holothuria miliaris*, Quoy and Gaimard, 1833. Voy. de l'Astrolabe, Zool., vol. 4, p. 137.

*Mülleria miliaris*, Brandt, 1835. Prod. Desc. Anim., p. 74 (et auct.)

Two large specimens (Nos. 218, 219) without data, except "West Australia," are in the collection. The generic name *Mülleria* has so often been shown to be preoccupied, so far as holothurians are concerned, there can be no justification for its further use instead of Brown's suggested substitute, *Actinopyga*.

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### STICHOPUS, sp. ?

Three large holothurians (No. 4939) from between Fremantle and Geraldton seem to belong to the genus *Stichopus*, but they are so contracted and distorted and the body surface is so rubbed that it is impossible to determine them satisfactorily. They do not seem to be *S. variegatus* and I think they probably represent an undescribed species.

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### HOLOTHURIA ATRA

Jaeger, 1833. De Holoth., p. 22.

These specimens which range from 100 mm. to 250 mm. in length seem to be identical with similar individuals from the Philippine Islands, and I see no reason to doubt that they are *atra*. There are no data with them but they are from "West Australia" and bear the Nos. 213, 215 and 216. Three specimens.

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### HOLOTHURIA, sp. ?

There is a small, decalcified holothurian (No. 251) from "Pelsart Island, Abrolhos, W.A.," which unfortunately cannot be determined.

*Museum of Comparative Zoology,*  
*Cambridge, Mass., U.S.A.,*  
*June 1st, 1913.*